3 Geometry and trigonometry

Teaching support and guidance

Concepts

- Space
- Quantity
- Relationships

Outcomes

Students will understand how we use geometry and trigonometry to quantify the physical world and enhance our spatial awareness.

Conceptual Understandings

- The properties of shapes depend on the dimension they occupy in space.
- The relationships between the length of the sides and the size of the angles in a triangle can be used to solve many problems involving position, distance, angles and area.
- Position and movement can be modelled in 3D space by vectors.
- The relationships between algebraic, geometric and vector methods can help us to solve problems and quantify those positions and movements.

Inquiry Questions

- Factual: How do we measure an angle?
- Conceptual: How many solutions to an equation are there?
- Debatable: Are three dimensions enough to describe locations?

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Factual: How do we measure an angle?

Conceptual: How many solutions to an equation are there?

Concepts: Quantity, Relationships

Standard Level

PowerPoint: Proofs of sine and cosine rules (S3.2)

These proofs are not straightforward; however, they provide an excellent discovery task. Students could attempt each proof, working in a group, and then discuss it, working through the PowerPoint. Alternatively, the PowerPoint offers scaffolding for a formal teacher-led approach to the proof of each rule.

Activity: Unit circle (S3.5)

Let students attempt the investigation, using the coordinates from the unit circle to generate the sine, cosine and tangent curves. Emphasize how the systems can be manipulated, using knowledge about the transformation of graphs (from the previous unit).

It is also important to emphasize the use of transforming graphs from Unit 2 when answering the questions on the task.

PowerPoint: Radians (S3.4)

Immediately after you complete the unit circle activity, talk to the students about radian measures.

Using the PowerPoint, discuss with students the need for radians measures and how to convert between degrees and radians. The emphasis should be on the fact that in order to draw a scale version of each trigonometric function we need to have different units on the x- and y-axes. Using radians allows use of the same units on both sets of axes. There are images to show the differences in appearance when using degrees and radians.

Higher Level

PowerPoint: Do you speak Babylonian? (H3.9)

This PowerPoint revisits the issue of radians discussed at Standard Level and addresses the TOK question: *Why do we use radians?* Teacher notes are included; however, it is a useful class discussion using the images in the presentation.

Debatable: Are three dimensions enough to describe locations?

Concept: Space

Higher Level

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PowerPoint: Introduction to vectors (H3.12)

This PowerPoint leads students through most of the ideas surrounding vectors, it forms an introduction to the topic and enables students to understand the significance of the language and how it is used in this topic. Further links are provided for class discussion.

Links: Vectors (H3.12–H3.18)

Vectors form a large part of the HL material in the Analysis and approaches course. It is a very content-heavy topic; however, there are opportunities for TOK discussions throughout. The following websites offer discussion points related to location:

- TOK: https://plus.maths.org/content/teacher-package-vectors-and-matrices
- Honeybees dancing: www.youtube.com/watch?v=4NtegAOQpSs
- Carl Sagan: www.youtube.com/watch?v=N7K5KjOdLD8
- Maths is Fun: www.mathsisfun.com/algebra/vectors.html

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